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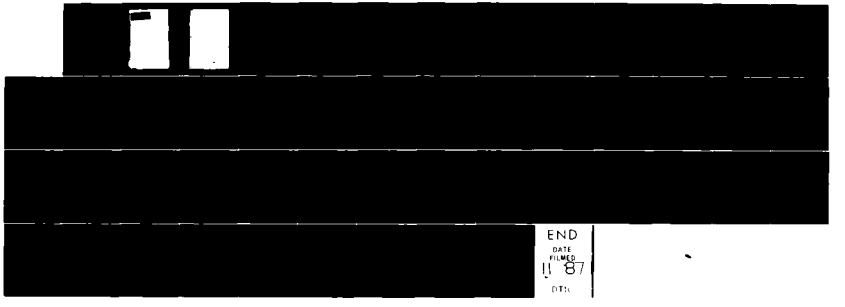

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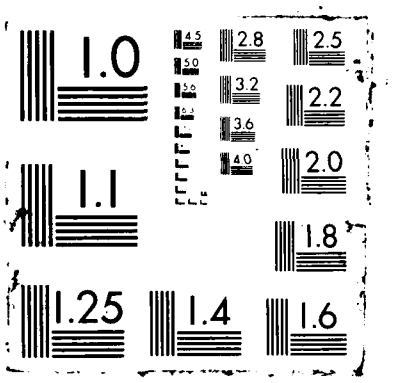
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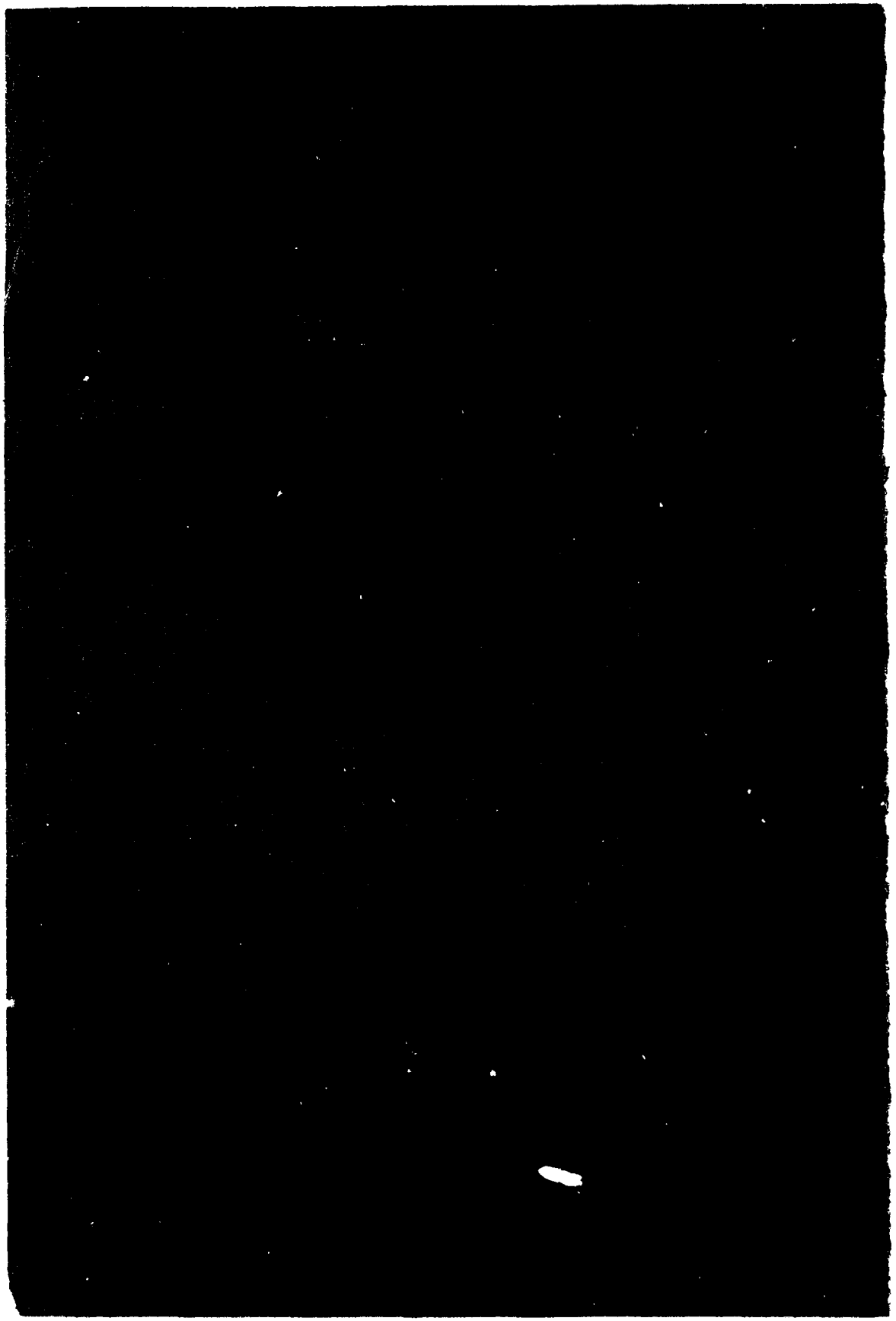

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This report explores the major contribution that a conventionally armed heavy bomber force could make to U.S. national security. It examines (1) the potential military and political utility of a bomber force armed with modern conventional weapons and munitions, (2) the approach for obtaining the requisite capabilities for such a force, and (3) the implications of a conventionally armed bomber force for U.S. arms control policy.

R-3508-AF

The Military and Political Potential of Conventionally Armed Heavy Bombers

Stephen T. Hosmer, Glenn A. Kent

August 1987

A Project AIR FORCE report
prepared for the
United States Air Force

RAND

PREFACE

This report explores the major contribution that a conventionally armed heavy bomber force could make to U.S. national security. It examines (1) the potential military and political utility of a bomber force armed with modern conventional weapons and munitions, (2) the approach for obtaining the requisite capabilities for such a force, and (3) the implications of a conventionally armed bomber force for U.S. arms control policy.

The study was conducted for the Strategic Air Command (SAC) under the Project AIR FORCE National Security Strategies program. It should be useful to U.S. Air Force, Department of Defense, and other national security officials concerned with organizing, equipping, and training U.S. forces for conventional conflicts and to decisionmakers dealing with U.S. arms control policy.

SUMMARY

The United States now has a unique opportunity to acquire a significant conventional bomber force at an affordable cost, thanks to

- **The availability of a substantial number of B-52s for other than strategic nuclear missions.**
- **The emergence of new technologies that provide the means to equip these heavy bombers with a potent conventional capability.**

Moreover, politico-military trends suggest that the United States will have to rely increasingly on the type of rapidly deployable conventional firepower that heavy bombers can provide to defend its allies and other interests around the world. The trends include:

- The perceived need for stronger conventional defenses to offset the eroding credibility of the nuclear deterrent.
- Adverse shifts in the conventional military balance.
- The emergence of threats, such as state-sponsored terrorism, that are likely to require rapid U.S. military response without the use of foreign air bases or airspace.

In addition, the following potential constraints on U.S. military options also point to the need for rapidly deployable conventional firepower:

- The American public's reluctance to accept high U.S. casualties or protracted U.S. military involvements.
- The danger that future attacks will catch the United States and its allies by surprise.
- The risk that forward-deployed U.S. tactical air units may be unable to execute time-urgent strike missions.
- The growing political and budgetary constraints that will prescribe less U.S. reliance on forward-deployed forces and more on centrally based, highly flexible swing forces.

Conventionally armed long-range bombers, along with tankers, admirably accommodate these trends and constraints. Heavy bombers can

- Operate from continental U.S. bases; thus they are not vulnerable to surprise attacks by enemy theater forces and are less vulnerable to the political constraints that foreign governments may impose.
- Exploit the economies of central basing and rapidly deliver heavy firepower to widely separated areas of the globe.
- Launch on short notice and reach any target from the United States within 24 hours.

Newly emerged technologies present the opportunity to significantly increase the potential effectiveness of conventionally armed heavy bombers. These technologies portend sensors and onboard engagement systems that will enable long-range standoff cruise missiles carried by B-52s to effectively attack various targets deep in enemy territory. Stealth technology should allow the advanced technology bomber (ATB) to penetrate to the vicinity of targets, where a weapon system operator can control the engagement, even in a sophisticated, high-threat air-defense environment.

A conventionally armed heavy bomber force could make a critical contribution to the defense of U.S. national security interests by

- **Countering aggression in a broad range of scenarios, including attacks against Western Europe, Iran, Thailand, and South Korea.**
- **Helping to force war termination and enforce the subsequent peace.**
- **Retaliating against state-sponsored terrorism.**
- **Helping to deter aggression and enhancing the credibility of U.S. commitments.**

The combat missions for conventionally armed bombers would include:

- Denying or delaying the insertion, reinforcement, and supply of enemy ground forces by air, land, or sea.
- Neutralizing enemy capabilities to operate fighter and attack aircraft from specific bases.
- Destroying high-value enemy targets with precision.
- Providing intermittent air support to indigenous ground forces.

Assuming that the United States must be prepared to cope with two major conflicts simultaneously—for example, concurrent attacks against Europe and South Korea—**we believe the United States**

should dedicate a force of approximately 75 to 100 heavy bombers to conventional missions. This force should not be used to support the single integrated operations plan (SIOP); rather, it should be committed exclusively to missions with conventional weapons to ensure that (1) the bombers will always be available for conventional operations at times of U.S.-Soviet crisis; (2) SIOP forces will not suffer attrition in a conventional mission; and (3) the conventional missions will receive adequate training, planning, and equipping.

Ideally, the United States should seek to exclude from future nuclear arms control ceilings any heavy bombers that are to be used exclusively in a conventional role. If the United States accepts a nuclear arms control agreement that requires nonnuclear heavy bombers to be counted under such ceilings, it should ensure that the ceilings on delivery vehicles and the counting rules on weapons will accommodate both the nuclear force to support the SIOP and the dedicated conventional force needed for other conflicts.

Among its other arms control objectives, the United States should strive to protect the option to equip B-52s with conventionally armed long-range cruise missiles. Should a future nuclear arms control agreement essentially rule out equipping a dedicated bomber force with conventionally armed long-range cruise missiles, ATBs—which will not require cruise missiles for standoff—would have to be introduced into the conventional force at an early date, if an effective capability with conventional weapons is to be realized.

The U.S. Air Force, in turn, should establish the capability to accomplish these vital combat missions with a conventionally armed bomber force. To do so, it should ensure

- A consensus at the highest levels to organize, equip, and train dedicated bomber units (B-52s now and ATBs later) with modern conventional weapons. Specifically, a *firm* decision is needed in the near future to retain and equip with modern conventional weapons the 69 B-52Gs scheduled to be dedicated to conventional missions.
- An agreed concept of operations of how each mission is to be accomplished.
- A sustained dedication to pursue the programs that will equip the bombers with appropriate sensors, engagement systems, weapons, dispensers, and munitions, as dictated by the agreed concept of operations.

ACKNOWLEDGMENTS

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CONTENTS

FIGURES

ACRONYMS

ALCM	air-launched cruise missile
APCs	armored personnel carriers
ATB	advanced technology bomber
BKEP	boosted kinetic-energy penetrator
CEB	combined-effect bomblet
CO_2 LADAR	carbon dioxide laser for detection and ranging
CONUS	continental United States
DMZ	demilitarized zone
ERAM	extended-range mine
GPS	global positioning system
IIR	imaging infrared
LOCs	lines of communication
MMW	millimeter wave
POL	petroleum, oil, and lubricants
ROK	Republic of Korea
SACEUR	Supreme Allied Commander Europe
SIOP	single integrated operations plan
WSO	weapon-system operator

I. INTRODUCTION

This report examines the potential contribution of a modernized, conventionally armed heavy-bomber force to U.S. national security. Such a bomber force could underwrite U.S. security objectives in diverse regions of the world by:

- Enhancing the credibility of U.S. security commitments and deterring attacks on U.S. allies and other interests.
- Contributing to the defense of U.S. allies and interests should deterrence fail.
- Helping to force the early termination of conflicts on terms acceptable to the United States.
- Helping to enforce any peace agreements that may follow future hostilities.

The first four sections of the report focus on the potential political and military utility of a bomber force armed with modern conventional weapons and munitions. Section II identifies the trends and constraints that will probably force the United States to rely on rapidly deployable conventional firepower in future conflicts.

Section III elucidates the important combat missions that heavy bombers could perform in the defense of Western Europe, Iran, Thailand, and Korea. These missions include (1) denying, or at least delaying, the movement and supply of enemy ground forces, (2) neutralizing enemy air operations, (3) destroying specific enemy high-value targets, and (4) providing intermittent air support to indigenous ground forces. It also examines the value of long-range bombers for retaliating against state-sponsored terrorism and assesses their potential contribution to deterring future aggression. Section IV suggests how the United States might insulate a conventionally armed bomber force from future arms control constraints.

Section V reviews options for achieving the requisite capabilities for a conventional bomber force. It identifies several emerged technologies related to missiles, engagement systems, and conventional munitions that would provide the basis for equipping heavy bombers to execute the missions discussed in Section III.[1] It offers a first-order assessment of how effectively each mission might be accomplished,

[1]We define as "emerged" any technology that is sufficiently advanced to warrant the initiation of a full-scale program to develop an operational system based on that technology.

depending on whether the attacking bombers penetrated to the vicinity of the target or stood off and used long-range cruise missiles. The tanker support that bomber missions in different geographic regions are likely to require and the probable cost and longevity of a conventionally armed B-52 force are also examined. Finally, the report suggests what the Air Force might do to achieve an effective conventional capability with heavy bombers.

II. GROWING REQUIREMENT FOR RAPIDLY DEPLOYABLE CONVENTIONAL FIREPOWER

Although conventionally armed bombers played an important role in America's most recent wars, U.S. leaders have tended to calculate the military worth of and need for heavy bombers largely in terms of their strategic nuclear mission. As a result, the requirements of the single integrated operations plan (SIOP) primarily have dictated the sizing of the U.S. heavy bomber force and the design of its weapon inventories. Because of this nuclear focus, the United States has not devoted adequate attention and resources to developing the conventional capabilities of heavy bomber units.[1]

A confluence of factors makes this a propitious time to organize, equip, and train heavy bomber units to provide the United States with a significant conventional bomber capability:

- Politico-military trends and constraints dictate that the United States increase its capabilities to rapidly deliver conventional firepower to widely separate points around the world.
- A substantial number of B-52s will soon be available for assignment to a dedicated conventional bomber force.
- Emerged technologies now provide the means to equip heavy bombers with a potent conventional capability.

As a result, the United States now can create a conventional bomber force that would effectively *complement* the capabilities of other U.S. conventional forces. Most important, such a bomber force would provide U.S. theater commanders an alternative for use when and where land-based or naval-based tactical air units might not be able to accomplish key missions at critical times.

Moreover, by utilizing B-52s that would be decommissioned if they were not assigned to a conventional role, the United States has the unique opportunity to acquire a significant new military capability at an *affordable cost.*

Politico-military trends suggest that the United States will have to rely increasingly on rapidly deployable conventional firepower—

[1]For a discussion of the conventional uses of heavy bombers since World War II, including the assignment of B-52s to the Strategic Projection Force (SPF) created in 1980, see Col. Thomas A. Keaney, *Strategic Bombers and Conventional Weapons: Airpower Options*, National Security Affairs Monograph Series 84-4, National Defense University Press, Washington, D.C., 1984.

precisely the kind of firepower provided by the heavy bomber—to defend its allies and other interests around the world. These trends include:

- The perception that the United States may prove unwilling to use nuclear weapons *first* in a future conventional conflict because of the fear of escalation and the catastrophic consequences of nuclear war. This perception has reinforced a growing belief within the Western alliance that stronger conventional defenses are needed to offset the eroding credibility of the nuclear deterrent.
- The adverse shifts in the conventional military balance that have resulted from (1) the sustained buildup of Soviet and other Warsaw Pact forces in Europe; (2) the USSR's improved force-projection capabilities for operations elsewhere along its periphery; and (3) the growing military power of Soviet clients, particularly North Korea and Vietnam. Because the local military balance is likely to favor these communist powers in future conventional conflicts, the United States and its allies will need to extract the maximum contribution from *all* of their combat forces.
- The emergence of threats, such as state-sponsored terrorism, that are likely to require the United States to mount rapid military response without the use of foreign air bases or airspace.

In addition, potential constraints on U.S. military options also point to the U.S. need for rapidly deployable conventional firepower. Such constraints include:

- The American public's manifest reluctance to accept high U.S. casualties or to tolerate protracted U.S. military involvements in conflicts. These constraints will increase U.S. decisionmakers' incentives to substitute American firepower for American manpower in future wars and to rely on the use of firepower to encourage the rapid termination of conflicts.
- The danger that future attacks by the USSR or its militarily powerful clients will catch the United States and its allies by surprise and give the defenders no opportunity to redeploy or mobilize forces prior to D-Day.[2] As a consequence, the United

[2]A 1985 study of European security, for example, argued that "surprise is playing an increasingly larger role in Soviet strategy." According to the study, "ever-diminishing warning times" could give the Soviet Union a greater potential to catch NATO forces in a vulnerable position at the outbreak of hostilities. See General Johannes Steinoff, "Dream or Reality: Hardware for FOFA," *NATO's Sixteen Nations*, May 2, 1985, p. 26. In Korea, the deployment of additional North Korean troops near the demilitarized zone

States may have to conduct an initial defense with only the forces that are routinely stationed in the immediate area of the aggression or that can be committed promptly to the battle from other U.S. overseas bases or directly from the United States.

- The risk that forward-deployed U.S. tactical air units may be unable to execute important time-urgent strike missions because such units will not have a sufficient operational radius to reach the targets, will have been neutralized by enemy surprise attacks, or will have been denied the use of needed bases. Carrier-based air assets also may be unavailable for these critical missions, either because the requisite carrier task force is not stationed within reach of the targets or has been neutralized by enemy attacks.
- The growing political and budgetary constraints that are likely to require the United States to rely less on forward-deployed forces and more on centrally based, highly flexible swing forces that can be rapidly committed to contingencies in widely separated areas.

Conventionally armed long-range bombers admirably accommodate both the above politico-military trends and the constraints that are likely to limit future U.S. military options. Bombers based in the continental United States (CONUS) are not vulnerable to surprise attacks by enemy theater forces.[3] Long-range bombers exploit the economy inherent in a centrally based swing force that can rapidly deliver *heavy* firepower to widely separated areas of the globe. They can launch on short notice and reach any target from the United States within 24 hours.

Moreover, conventionally armed bombers could effectively operate in most areas of Eurasia without the use of foreign bases for either the bombers themselves or their supporting tankers. Heavy bombers would not necessarily require support from foreign bases for sustained opera-

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(DMZ) is reported to have sharply reduced the warning time that South Korea and U.S. forces would have of an impending invasion. In the view of some observers, the placement of these additional North Korean forces in forward areas reduced the expected warning time from 24 to only 6 hours. See Bill Gertz, "N. Korea Troops Near Border Alarm U.S.," *Washington Times*, May 2, 1985, p. 5, and "S. Korea's New High-Water Mark May Provoke Attack, General Says," *Washington Times*, October 16, 1985, p. 4.

[3]The Soviets have or could have the capability to attack bombers based on U.S. territory with conventionally or nuclear-armed strategic missiles or long-range bombers. Given the risks of miscalculation and escalation, however, the USSR seems unlikely to exercise this option to support a conventional offensive along its periphery.

tions in Central Europe, Northeast Asia, and Southeast Asia.[4] Sustained operations in Southwest Asia would depend on foreign bases, but even in that region, the political constraints that a foreign government might impose would impede bombers far less than land-based tactical aircraft.[5]

Finally, newly emerged technologies will significantly increase the potential effectiveness of conventionally armed heavy bombers. These technologies could lead to sensors and on-board engagement systems that will enable B-52s carrying long-range standoff missiles to effectively attack targets deep in enemy territory. Stealth technology should allow the advanced technology bomber (ATB) to penetrate to the vicinity of targets, even in sophisticated, high-threat air-defense environments. Equipped with appropriate conventional weapons and munitions, bombers will have a potent capability to execute military missions that could significantly affect the outcome of a future conflict. Indeed, in some circumstances, long-range bombers may provide the only U.S. force available to execute these crucial military missions.

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[4]Guam would provide a politically secure forward base for sustained bomber operations in Southeast and Northeast Asia.

[5]For one thing, the long range of U.S. bombers and tankers allows the United States considerable flexibility as to where these aircraft could be based to conduct sustained operations in Southwest Asia.

III. MISSIONS FOR CONVENTIONALLY ARMED BOMBERS

COUNTERING AGGRESSION

A heavy bomber force carrying modern conventional weapons could perform combat missions that would significantly improve the prospects for containing future aggression. Indeed, as the subsequent discussion will show, a conventionally armed bomber force could prove extremely useful should the USSR and its Warsaw Pact allies launch a conventional attack against Western Europe, the USSR mount an all-out invasion of Iran, Vietnam invade Thailand, or North Korea attempt to overrun South Korea.

Although different in scale, locale, and mix of combatants, these four contingencies would all:

- Threaten important U.S. security interests and require some form of U.S. military response.
- Militarily test the defenders. Indeed, the United States and its allies might be hard-pressed to mount an effective conventional defense in any of the contingencies.
- Possibly catch the United States and its allies sufficiently by surprise to rule out the mobilization or pre-positioning of additional defensive forces prior to the attack.
- Require the available defensive forces to hold the line or at least slow the enemy's advance until adequate reserve forces could mobilize and outside reinforcements arrive.
- Raise doubts that the United States could, at the outset of the conflict, rely on ground-based or naval-based tactical air to conduct interdiction and other vital attack missions to contain or slow the enemy's advance.
- Provide opportunities for conventionally armed bombers to significantly support the U.S. and allied land battle and to importantly *complement* the contributions made to the defense by U.S. land-based and/or naval-based tactical forces.

While the missions appropriate for heavy bombers would vary somewhat with each contingency, they would include operations designed to:

- Deny or at least delay the insertion, reinforcement, and supply of enemy ground forces by air, land, or sea.

- Neutralize enemy capabilities to operate fighter/attack aircraft from specific bases.
- Destroy high-value enemy targets with precision.
- Provide intermittent air support to indigenous ground forces.[1]

Warsaw Pact Invasion of Western Europe

In the event of a Warsaw Pact short-warning attack on NATO, U.S.-based conventionally armed bombers could provide crucial help to the defense by delaying, disrupting, and destroying Soviet follow-on forces en route to the central front from the USSR. These follow-on forces, armored and motorized rifle divisions stationed in the western USSR, would be expected to begin transiting Poland and Czechoslovakia shortly after the commencement of hostilities to reinforce the Warsaw Pact attack. Most would move to forward staging areas by train.

Inasmuch as some 25 divisions, if unimpeded, could cross Poland and Czechoslovakia in about two weeks, any NATO operations to interdict their movement would have to begin immediately after hostilities commenced. Promptness would be essential because Soviet follow-on divisions in a high state of readiness might begin to cross Poland and Czechoslovakia prior to the actual outbreak of hostilities.[2]

NATO-based tactical aircraft are unlikely to be available for such interdiction missions. Moreover, these tactical aircraft at best would have limited payload at the combat radius required to attack the Soviet follow-on forces while they were still confined to the relatively austere transportation networks of eastern Poland. Consequently, such interdiction operations would probably require heavy bombers.

Operating from bases in the United States, conventionally armed heavy bombers could impede the movement of these Soviet follow-on forces by:

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[1]The bomber would be most likely to be able to provide such support when it could penetrate sufficiently close to the battlefield to allow a weapon-system operator to direct a dispenser to lay down a pattern of fire precisely in the area designated by friendly forces on the ground. However, such air support would not be continuous or responsive to changing battlefield needs unless the bomber was able to loiter safely in the vicinity of the battlefield. Long-range cruise missiles would probably not be used to provide air support to indigenous forces except as a last resort in situations where the battlefield was static. See below, pp. 28–29.

[2]Of some 34 Soviet line divisions assigned to the Warsaw Pact western strategic theater but stationed inside the USSR, about 11 are estimated to be category 1 or 2 divisions. See The International Institute for Strategic Studies, *The Military Balance 1985–1986*, London, 1985, pp. 26–27.

- Dropping key bridges along Polish and Czechoslovak roads and railroads and mining the areas near the damaged bridges to delay their repair.
- Mining roadbeds and attacking troop and other military trains directly to derail and destroy them. This would force the divisions that were to have traveled by train onto constricted road networks.
- Destroying Soviet tank transporters, troop trucks, and mechanized vehicles moving along these road networks.

The interdiction of Soviet follow-on forces in Poland and Czechoslovakia could significantly increase the prospects for a successful conventional defense of Europe, especially in the event of a short-warning attack.[3] A robust conventional defense capability would serve both to deter such aggression in the first place and to reduce the risks of nuclear escalation if deterrence failed. The destruction and disruption of Soviet reinforcements before they could engage in the main battle would:

- Reduce the overall weight of the Warsaw Pact offensive and help preserve the ground force ratios necessary to permit a coherent NATO defense.
- Disrupt the timing of the Warsaw Pact attack and diminish the Pact's capability to exploit breakthroughs.
- Buy crucial time for the mobilization of NATO forces and for the arrival of reinforcements from the United States.

The capability to effectively interdict Soviet follow-on forces moving toward NATO from the USSR could gain even greater importance in the event that the United States and the USSR successfully negotiated a conventional arms reduction agreement for central Europe. The military risks of such an agreement for NATO—particularly with regard to a short-warning attack—would diminish if the United States could in wartime disrupt and delay the return of any divisions withdrawn to the USSR following the agreement.

[3]A U.S. capability to interdict Soviet follow-on forces in Poland and Czechoslovakia might reduce the potential advantages of a short-warning attack in the eyes of Soviet planners. In the event that the Soviets, for this and other reasons, were to eschew a short-warning attack and opt instead for a longer mobilization period that would allow them to pre-position their forces in forward areas prior to D-Day, the NATO countries would gain more time to mobilize and reposition their defensive forces. If NATO forces were in position prior to an attack, the chances for a successful defense could increase significantly.

Soviet Invasion of Iran

A modernized bomber force could add decisively to the defense of Southwest Asia. A Soviet invasion of Iran might impel the United States to intervene with its own forces to block a Soviet advance to the Khuzistan oil fields and the Persian Gulf. To gain time to interpose U.S. ground forces in Iran (for example, in the Zagros mountains), U.S. commanders might seek to disrupt and delay the Soviet advance.

Conventionally armed bombers could weaken the Soviet invasion force and significantly slow its rate of movement by:

- Closing the key choke points—bridges, tunnels, and landslide areas—along the Soviet invasion routes through northwestern and northern Iran.
- Attacking Soviet tanks and other motorized forces deployed along these invasion routes. The targets for such attacks should be particularly lucrative where the terrain would limit off-road deployments behind closed choke points.
- Cratering the runways and destroying the support facilities of Iranian air bases already occupied by Soviet forces or in danger of imminent Soviet capture. The interdiction of Iranian airfields would (1) deny air cover and tactical air support to Soviet ground units operating beyond the range of USSR-based tactical aircraft, (2) prevent the USSR from using these facilities to insert or resupply Soviet ground forces, and (3) reduce the Soviet air threat to the U.S. forces deploying to Iran.
- Attacking Soviet assembly areas in Iran.
- Providing intermittent air support to Iranian troops engaging Soviet forces.

Several of these missions would be extremely time-urgent. The U.S. forces would have to strike bridges, tunnels, and landslide areas to deny the Soviet forces passage. Since many of the most important choke points lie close to the Soviet border in northwestern Iran, the United States would have to initiate air attacks promptly. Similarly, it would have to strike Iranian airfields vulnerable to Soviet capture before the Soviets could make effective operational use of them.

Heavy bombers may be the only forces able to perform these time-urgent missions. A Soviet invasion—particularly one preceded by gradually increasing Soviet force readiness in the military districts bordering Iran—might catch the United States by surprise and allow no opportunity for the deployment of U.S. naval or ground-based tactical air to the Persian Gulf region prior to the attack.

Even with advance warning, political constraints might preclude the U.S. deployment of tactical air units to Iranian or other Persian Gulf bases prior to D-Day. While U.S. carriers in the Persian Gulf area would escape such political restrictions, carrier-based aircraft launched east of the Strait of Hormuz could not reach many important choke points and other targets in northwestern Iran. Carrier forces also could not match the bomber force's capacity to deliver heavy firepower even at modest ranges from the carrier.

Vietnamese Invasion of Thailand

Heavy bombers might also play a crucial role in defending Thailand, which Vietnam's military lodgments in Laos and Cambodia will continue to threaten. A major Vietnamese invasion of Thailand—say, in an attempt to force the Bangkok government to terminate its assistance to the Cambodian resistance—would strongly pressure the United States to intervene on its ally's behalf.

A U.S. combat intervention would have the immediate objectives of preventing the Vietnamese from overwhelming Thailand's military forces, capturing Bangkok, and extracting humiliating political concessions from the Thai government. Given Vietnam's manifest military superiority over Thailand, the United States would have to intervene promptly to forestall a total Thai collapse. However, U.S. naval- and ground-based tactical air forces might not be positioned to respond rapidly, since a Vietnamese attack could probably be mounted with little or no advance warning.[4]

Thus, heavy bombers might be the only U.S. forces immediately available to help stiffen the Thai defenses and slow the Vietnamese advance until U.S. ground forces and tactical air units could deploy to Thailand. Among other contributions, heavy bombers could:

- Attack road and railroad bridges, ferries, and transshipment points along the lines of communication (LOCs) in Thailand, Laos, Cambodia, and Vietnam supporting the invasion forces.[5]
- Mine the ports and inland waterways of Cambodia and Vietnam.
- Attack Vietnamese armored forces and other vehicular traffic moving along the austere road networks leading into Thailand from Laos and Cambodia.

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[4]Hanoi could be expected to attempt to mask its intentions and invasion preparations so as to present the United States with a fait accompli.

[5]Given the demonstrated capacity of the People's Army of Vietnam (PAVN) to rapidly repair LOCs and bypass choke points, such attacks at best would probably only reduce the pace and weight of the Vietnamese offensive.

- Provide intermittent air support to Thai ground forces.
- Attack Vietnamese air facilities supporting the invasion and deny Vietnam the use of Cambodian, Laotian, and captured Thai air facilities for fixed-wing combat operations and air resupply. The objective of these attacks would be to prevent the Vietnamese from providing air defense or tactical air support to their invasion force.
- Destroy Vietnamese petroleum, oil, and lubricant (POL) stocks and pipelines, ammunition depots, and truck parks in Laos and Cambodia.

Aside from the direct military contributions that U.S. heavy bombers would make, their early engagement could have a major salutary effect on Thai military morale. The Thai would perceive the U.S. bomber operation as an earnest of the U.S. resolve to support Thailand and could help to keep the Thai troops fighting.

North Korean Invasion of South Korea

Heavy bombers could add greatly to the successful defense of South Korea. Should North Korea again invade South Korea, it would most likely rely on a blitzkrieg attack to overwhelm U.S. and South Korean defenses. North Korea's strategy would rely on surprise and the numerical superiority of its frontline forces to win before the Republic of Korea (ROK) could mobilize its reserves or the United States send reinforcements.

Thus, the first few days of a new Korean war would undoubtedly be critical. The defenders would have to be able to slow and weaken the North Korean attack sufficiently to allow time for South Korea and the United States to mobilize and reinforce their forces and to reconstitute damaged forces. The defenders would also have to be able to stop the invasion north of Seoul, which lies close to the demilitarized zone (DMZ) and contains one-quarter of South Korea's population.

Heavy bombers could help significantly to disrupt and slow the North Korean advance by interdicting the movement of follow-on forces and supplies to the front. Exploiting the vulnerabilities of North Korea's limited rail and road systems, U.S. bombers could:

- Drop bridges along the railways and roads situated behind the primary North Korean invasion corridors.
- Mine railroad beds to cause train derailments.
- Attack North Korean troop and supply trains along the railroad lines and strike trucks and armored vehicles along the roads. As in the case of Iran, such attacks would likely yield

particularly good results where mountainous terrain hindered North Korean attempts to bypass closed choke points.

In addition to interdicting North Korean transportation networks, heavy bombers could also:

- Crater the runways of North Korean airfields and attack North Korean air defense headquarters.
- Mine and attack harbors to deny the maritime resupply of North Korea and neutralize its naval forces.
- Provide intermittent air support to ROK ground forces.

South Korean and U.S. ground-based and naval-based tactical aircraft in or near Korea might not suffice to execute all of these missions immediately following the outbreak of hostilities. North Korea is capable of attacking South Korea with little or no advance warning, so the United States would probably not have an opportunity to deploy additional U.S. forces to Korea prior to D-Day. The disruption caused by North Korean air strikes and special-force attacks against the allied air facilities in South Korea might also constrain South Korean and U.S. capabilities for mounting immediate tactical air attacks on the North.

Furthermore, whatever South Korean and U.S. tactical air remained operational after a North Korean attack might be too preoccupied with close air support or air-defense missions to conduct interdiction or airbase attacks against the North. Thus, externally based heavy bombers might be the only force that could guarantee the prompt destruction of time-urgent and high priority targets, such as the railway and road bridges supporting the North Korean invasion corridors.

HELPING TO FORCE WAR TERMINATION AND ENFORCE PEACE

The United States would probably also need conventionally armed bombers to help force war termination on militarily powerful Soviet clients like Vietnam and North Korea and to help enforce the subsequent peace with such states.

The American public's aversion to prolonged and costly U.S. combat involvements dictates that U.S. leaders must seek to terminate future conflicts quickly. Should the United States become involved in a new conflict with Vietnam or North Korea, U.S. decisionmakers would strive to prevent U.S. forces from again becoming bogged down in casualty-intensive and protracted ground campaigns against adversaries uniquely suited to wars of attrition.

In addition to wanting to avoid high American casualties, U.S. leaders would probably shy away from engaging in large-scale ground campaigns to force war termination in such conflicts because of the risks of Soviet intervention. Washington decisionmakers would be concerned that a dramatically successful U.S. or allied ground counteroffensive, say, one that drove deep into North Korea, might persuade the USSR that its client's survival was endangered and thus provoke a Soviet intervention.

As a result, U.S. leaders would probably rely on coercive air operations to help bring conflicts with Soviet clients to a rapid and successful conclusion.[6] To be effective, a coercive air campaign must be intense and militarily and politically sustainable for as long as required to force an end to the conflict. Thus, the air campaign would have to be conducted without the loss or capture of significant numbers of U.S. aircrews and without causing undue enemy civilian casualties.

Because of their carrying capacity and ability to strike deep into an enemy's homeland, the United States would likely rely upon suitably equipped heavy bombers to conduct many of the coercive missions, including

- Precision attacks on targets of important economic, political, or military value to the enemy.
- Isolation of the enemy from external military and economic resupply by mining its harbors and, if need be, interdicting its road and rail LOCs to neighboring countries.
- Suppression of enemy air defense so that U.S. and allied forces could sustain the coercive air campaign with minimum attrition.

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[6]In both the Korean and Vietnam conflicts, the United States eventually had to rely on intensified air campaigns—rather than on offensive ground operations—to create battlefield leverage to encourage war termination. In the case of Korea, the Eisenhower administration used a "pressure" air campaign against North Korea in 1953 along with an even more compelling threat to extend the war to China and to employ atomic weapons so as to force the Chinese and North Koreans to accept an armistice. In December 1972, the Nixon administration used massive B-52 bombing attacks against targets in Hanoi and Haiphong to force the North Vietnamese to conclude the Paris peace agreements. For a discussion of the "pressure" air campaign in Korea, see Robert Frank Futrell, *The United States Air Force in Korea, 1950–1953*, Duell, Sloan and Pearce, New York, 1961, pp. 623–629, 657–658. For a description of the 1972 Christmas bombing campaign against North Vietnam and its effect on the peace negotiations, see William W. Momyer (General, USAF [Ret]), *Air Power in Three Wars*, Department of the Air Force, Air University, Maxwell Air Force Base, Alabama, 1978, pp. 240–243, and Henry Kissinger, *White House Years*, Little, Brown and Company, Boston, 1979, pp. 1446–1461. For a more extensive discussion of the use of air operations to force war termination, see Stephen T. Hosmer, *Constraints on U.S. Strategy in Third World Conflict*, The RAND Corporation, R-3208-AF, September 1985.

Once a conflict has ended, the threat posed by a U.S. bomber force ready to renew coercive attacks should help to keep the peace. Experience teaches that would-be aggressor states will observe peace agreements only if they are convinced that the United States and its allies are resolved to enforce and capable of enforcing these agreements on the battlefield.

RETALIATING AGAINST STATE-SPONSORED TERRORISM AND OTHER HOSTILE ACTS

Heavy bombers capable of executing precision strikes in high-threat air-defense environments would also prove of great politico-military value should the United States have to conduct punitive or preemptive attacks against states sponsoring terrorism. Indeed, long-range bombers possessing such capabilities would have several advantages for this counterterrorist mission. They would enable the United States to

- Execute retaliatory attacks with little risk of aircrew losses or downed U.S. aircrews becoming hostages of the terrorist regime. B-52s equipped with long-range cruise missiles or ATBs equipped with short-range weapons controlled by weapon system operators could carry out such strikes.
- Attack military and other targets in terrorist states without causing the civilian casualties or collateral damage likely to provoke widespread domestic and international condemnation.
- Strike distant countries *without using the airspace or air facilities of other nations.* This capability would increase the U.S. freedom of action to engage in reprisal attacks and would reduce the risk of adverse international repercussions once the attacks had been carried out. The autonomous capability of heavy bombers would also finesse the risk that U.S. retaliatory strikes mounted with the cooperation of third countries might undermine pro-American governments in those countries.
- Retaliate promptly against terrorist acts without first having to position a carrier task force near the terrorist state or deploy USAF tactical aircraft to the region. A quick response to terrorist aggression might be expected not only to deter future terrorist acts more effectively, but also to produce less adverse political and diplomatic fallout than would a delayed reprisal.

For contingencies in which the United States sought to apply sustained pressure on a terrorist state—say, to secure the release of U.S. hostages—it could use heavy bombers to seed hard-to-sweep mines in

the aggressor's harbors or rivers. Such mining operations could be rapidly mounted directly from the United States without running the possible political risks that would attend the use of forward-deployed U.S. air or naval forces that must rely on the continued goodwill of third nations for their basing and support facilities.[7]

Heavy bombers could also respond to other potential threats to U.S. interests in the Third World, particularly those requiring the precise application of U.S. firepower without the use of foreign bases or the loss of U.S. aircrews and aircraft.

ENHANCING DETERRENCE

If its capabilities were suitably advertised, a conventionally armed, modernized bomber force could contribute importantly to deterring enemy attacks on U.S. allies and other vital interests. The potential threats to enemy assets and operations posed by the bomber force could influence enemy perceptions and behavior in several ways.

A modernized U.S. heavy bomber force could make a potential aggressor less certain about the likely success of a conventional attack. At the minimum, the threat posed by the bombers would probably force enemy commanders to divert greater resources to air defense and would encourage them to modify their operational plans.

The invulnerability of the heavy bomber force to preemptive conventional strikes by enemy theater forces could dilute some of the important advantages that the aggressor might expect to secure from a surprise attack. Enemy commanders could therefore insist on greater preparatory buildups and more favorable force ratios before embarking on any future aggression. These additional preparatory steps might in themselves provide the U.S. and its allies with valuable warning prior to an attack. Moreover, the larger the forces required for an attack and the greater the uncertainty about its success, the less likely enemy leaders will be to sanction such operations.

To the extent a heavy bomber force serves to deter a conventional war, it also serves to deter the potential nuclear war that might grow out of such a conventional conflict. Thus, enhancing deterrence against conventional attacks will also enhance deterrence against nuclear attacks.

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[7]The use of hard-to-sweep mines in such hostage situations would provide a number of other advantages as well. The mines would give the United States sustainable leverage over a hostile regime without necessarily inflicting repeated attacks on persons and property—attacks that might be more likely to bring harm to the American hostages, provoke worldwide political condemnation, or invite Soviet military intervention. See Stephen T. Hosmer and George K. Tanham, *Countering Covert Aggression*, The RAND Corporation, N-2412-USDP, January 1986.

The existence of the bomber force would also constitute an earnest of the U.S. resolve to defend its interests even in distant areas. It would put America's friends, as well as its potential enemies, on notice that the United States could rapidly deliver conventional firepower anywhere in the world if U.S. citizens, property, and allies are attacked.

The bomber force's capability to conduct sustained strikes against high-value economic, political, and military targets deep in an enemy's homeland and to mine his harbors and rivers would help persuade militarily powerful Soviet clients, such as North Korea and Vietnam, that the United States was prepared to extract a substantial price for their future aggression.

IV. PROTECTING OPTION FOR CONVENTIONALLY ARMED BOMBERS UNDER NUCLEAR ARMS CONTROL AGREEMENTS

Given the important contribution of bombers to the defense of U.S. global interests, the United States should avoid any arms control agreements that would prevent or discourage the maintenance of a substantial heavy-bomber force armed with modern conventional weapons.

Assuming that the United States must be prepared to cope with two major conflicts simultaneously—for example, concurrent attacks against Europe and South Korea—we believe that the United States should dedicate a force of approximately 75 to 100 heavy bombers to conventional missions.[1] This bomber force should not be used to support the SIOP or other nuclear missions; rather it should be committed exclusively to missions with conventional weapons to ensure that (1) the bombers will be available for conventional operations at times of U.S.-Soviet crisis; (2) SIOP forces will not suffer attrition in a conventional mission; and (3) the conventional missions will receive adequate training, planning, and equipping.

The U.S. Air Force is presently scheduled to introduce 69 B-52Gs into a bomber force dedicated to conventional missions. None of these 69 B-52s is equipped with cruise missiles. To be effective across the spectrum of scenarios described in this study, these B-52s will have to operate from standoff and will need to be armed with conventional cruise missiles with a range of well over 600 kilometers. Indeed, to attack targets in high-threat air-defense environments, B-52s will have to carry standoff cruise missiles with ranges of somewhere around 1000 kilometers.

Future nuclear arms control constraints might, however, rule out arming these bombers with cruise missiles with ranges of over 600 kilometers. The United States would probably be unwilling, for example, to equip its conventional bombers with such longer-range cruise missiles if doing so were to result in those conventional bombers being counted against a severely restrictive nuclear arms control subceiling on bombers equipped with long-range cruise missiles.

[1] In the event of a Warsaw Pact attack on NATO, we estimate that a force of from 50 to 75 bombers would be needed to interdict the movement of Soviet follow-on forces transiting Poland and Czechoslovakia. A simultaneous North Korean invasion of South Korea would require a somewhat smaller number of heavy bombers.

Several options might be considered for insulating conventionally armed bombers from future nuclear arms control constraints. Ideally, the United States should seek to exclude from future nuclear arms control ceilings any heavy bombers that are to be used exclusively in a conventional role.

To establish the feasibility of excluding such bombers from nuclear arms control ceilings, the United States must be able to demonstrate that one can distinguish between nonnuclear and nuclear heavy bombers, even when both are equipped with long-range cruise missiles. It must also be able to demonstrate that one can verify the transfer of a heavy bomber from a nuclear status to a nonnuclear status.

Some possibility exists for verifying the nuclear or nonnuclear status of heavy bombers. For example, the nonnuclear bombers could be restricted to a few designated bases. No nuclear weapons would be stored on these bases and on-site inspection would be allowed. Verifiable engineering changes might even be incorporated in aircraft to preclude a nonnuclear bomber's employment of nuclear weapons, including nuclear-equipped cruise missiles.

Should the United States accede to a nuclear arms control agreement that required nonnuclear heavy bombers to be counted under an arms control ceiling, it should ensure that the ceilings on delivery vehicles and the counting rules on weapons would accommodate both the nuclear force to support the SIOP and the dedicated conventional force needed for other conflicts.[2]

For example, to protect the option to equip B-52s with conventionally armed long-range cruise missiles, the United States should strive to have such bombers and missiles counted at a minimum rate against any delivery vehicle and weapon ceilings established in a future nuclear arms control agreement. Thus, in the context of the tentative arms control formula worked out between the United States and the USSR at the October 1986 meeting in Reykjavik, the United States should insist that a bomber equipped with conventional long-range cruise missiles be counted as only *one* each against the proposed arms control ceiling of 1600 delivery vehicles and the ceiling of 6000 weapons.

[2]As noted above, a future nuclear arms control agreement that, in addition to limiting both nuclear and nonnuclear bombers, specified a separate sublimit on bombers equipped with air-launched cruise missiles (ALCMs) would raise a serious barrier to the maintenance of a conventional bomber force. Under such an agreement, the nonnuclear B-52 bombers would be charged against both the overall ceiling on heavy bombers and the subceiling on heavy bombers equipped with long-range cruise missiles. An agreement that established a separate sublimit on ALCMs themselves could virtually rule out any large-scale use of cruise missiles for conventional missions, unless a verifiable distinction could be made between ALCMs equipped with nuclear warheads and long-range cruise missiles equipped with conventional munitions. These problems can be avoided if no such separate subceilings are established.

A count of more than one for a bomber equipped with conventionally armed cruise missiles would produce an illogical situation: The bomber equipped with nuclear bombs and nuclear short-range attack missiles would count less against the ceiling on nuclear weapons than the bomber equipped with conventional cruise missiles.[3]

Another way to protect the option to arm B-52s with conventional cruise missiles would be to redefine the range of the missiles that are to be included under nuclear arms control ceilings. The United States could seek to define long-range cruise missiles as missiles possessing a range in excess of 1000 kilometers rather than the 600 kilometers that was agreed in the SALT II negotiations.

If a future nuclear arms control agreement essentially ruled out equipping a dedicated bomber force with conventionally armed long-range cruise missiles but did not severely limit the bombers themselves, then ATBs—which will not require cruise missiles for standoff—should be introduced into a conventional bomber force at an early date.

Experience suggests that the United States may have difficulty negotiating with the Soviets measures to insulate conventional bombers from arms control constraints. Even so, to protect the option to deploy an adequate conventional bomber force, the United States should make the requirement for a nonnuclear bomber force an explicit part of U.S. arms control policy.

If feasible, the United States should seek to exclude nonnuclear heavy bombers from a future arms control agreement. If it cannot do so, it should ensure that any ceilings on delivery vehicles and any counting rules on weapons allow the United States to maintain an adequate conventional force. An arms control agreement designed to reduce the reliance on nuclear weapons should not be allowed to prevent the conversion of nuclear weapon platforms to nonnuclear status.

[3]The tentative Reykjavik formula would limit each superpower to 6000 strategic missile warheads and air-launched cruise missiles and 1600 delivery systems, including ballistic missiles and bombers. According to the Reykjavik formula, a strategic bomber carrying only nuclear bombs and short-range missiles would count as one against the 6000-weapon ceiling; each bomber carrying cruise missiles with ranges in excess of 600 kilometers, however, would count an agreed higher number, such as 12. See Walter Pincus, "Reagan's 'Dream' Was to Eliminate Ballistic Missiles," *Washington Post*, October 14, 1986, pp. A1 and A19.

V. OBTAINING REQUIRED CAPABILITIES WITH CONVENTIONAL WEAPONS

The emerged technology with potential application to air-launched missiles, sensors/engagement systems,[1] and conventional munitions now provides the opportunity to equip bombers to accomplish the missions described in Sec. III to underwrite the U.S. security objectives in NATO, Korea, Southwest Asia, and Southeast Asia. The missions include actions to:

- Deny or at least delay insertion, reinforcement, and resupply of enemy ground forces by land, air, or sea.
- Neutralize enemy capabilities to operate fighter and attack aircraft from specific bases.
- Destroy high-value enemy targets with precision.
- Provide intermittent air support to indigenous ground forces.

EMERGED CONVENTIONAL-WEAPON TECHNOLOGY

Missiles

Short-range data-link weapons with modest footprints—the GBU-15 and the AGM-130, for example—are already in the inventory for use when the bomber penetrates to the vicinity of the target.[2] Also, long-range cruise missiles now in production could be adapted to provide the capability to stand off from the target; e.g., variants of either the Boeing AGM-86B air-launched cruise missile (ALCM) or the General Dynamics BGM-109 Tomahawk could be used to deliver conventional munitions from standoff ranges. A single B-52 could carry 12 AGM-130 missiles or 12 long-range cruise missiles on its external pylons.

Sensors/Engagement Systems

The technology of sensors—imaging infrared (IIR), millimeter wave (MMW), and carbon dioxide lasers for detection and ranging (CO_2 LADARs)—has now reached the point of being able to provide the

[1]An engagement system on board a missile enables the missile to recognize targets and apply ordnance (warheads or dispensed munitions) at the proper place to destroy the targets.

[2]The AGM-130 is a rocket-assisted glide bomb with an imaging infrared sensor connected by data link to a weapon-system operator in the aircraft.

terminal guidance required for the effective use of conventional munitions. A weapon-system operator (WSO) connected by data link to one or more such sensors on a short-range weapon can quite straightforwardly control the terminal engagement, as has already been demonstrated with the AGM-130.

In an operation requiring long-range standoff from the target and employing long-range cruise missiles (typically one in which the bomber would otherwise have to penetrate a high-threat air-defense system), the engagement process is less straightforward but still workable. For this case, an on-board engagement system (such as computers with scene-matching algorithms) substitutes for the WSO. With the appropriate set of sensors and an on-board engagement system, long-range standoff missiles can accomplish the terminal engagement; e.g., it should be possible to have unitary warheads impact at a precise point to drop a bridge or to dispense bomblets along a particular stretch of road to destroy the vehicles on the road.

Mid-course guidance, such as GPS (a global positioning system based on satellites), can navigate the missile to a designated "basket" at the fixed target, where the terminal engagement system then takes over. Based on photographs of the target area, the terminal engagement system guides the missile along a predesignated course within the scene. This mode of engagement applies to attacking bridges, tunnels, facilities, runways, and aircraft on airfields and to mining railroads, roads, and harbors.

A mode of engagement that treats mobile targets as fixed also applies to attacking trains and military units on trains and roads. Predesignated stretches of road or rail are the fixed target. The task is then to make the missile smart enough to fly along the road or rail with the required precision, using photographs of the predesignated stretches taken in peacetime. In this case, however, the engagement system has an additional function to perform. It must be able to identify which specific portions of the designated stretch of road or rail are occupied by worthwhile targets and then dispense munitions efficiently over these targets. Scene-matching systems to accomplish these functions are currently being developed but have yet to be operationally demonstrated.

Conventional Munitions

Existing programs, if pursued with vigor, will provide an impressive family of munitions that will have the potential of being effective against a wide variety of targets. A combined-effect bomblet (CEB) has been developed and is now in production. When properly

dispersed over the target array by the weapon, the CEB will work quite effectively against trucks, lightly armored vehicles, unprotected troops, aircraft parked in the open or in revetments, radars, and soft support facilities on airfields.

The boosted kinetic-energy penetrator (BKEP) munition has been developed to penetrate runways and cause large craters. This munition may be used also to barrage areas where aircraft are parked in shelters.

The SKEET, a terminally guided munition now in full-scale development, should be effective against all types of vehicles with warm engines, including tanks, armored personnel carriers (APCs), and trucks. When dispensed over a target array, an infrared (IR) sensor on the munition recognizes the target, a warm engine. As the target comes within the sensor's bore-sight, the sensor then causes a self-forging fragment to propel toward the target and to penetrate the armor over the engine.

The GATOR mine has been developed and is in the process of being procured. This mine can kill tanks (and other vehicles) that pass directly over it. An extended-range mine (ERAM), the development of which has been deferred for budgetary reasons, has the potential to kill tanks and other vehicles that pass *near* it. By virtue of having an extended range, the mine may be emplaced in the cover along the side of the road and still be able to attack the vehicle on the road.

It should be possible to develop a new mine that when emplaced in the ballast of a railroad line would derail trains as they passed over the mine. Among other features, such a mine should leave a minimum scar in the ballast and have fuzes with time delays and other devices to make clearing difficult.

Unitary warheads for effective attack of hard targets (e.g. bridges, tunnels, and bunkers) have been developed. These include the 1000-pound-class warhead (previously developed for the Bull Pup) for use in cruise missiles and the newer 2000-pound-class warhead, the I-2000, for use in the AGM-130. Also, a new 1000-pound-class warhead for penetrating hard targets is now under development.

Finally, B-52s are already equipped with the Harpoon missiles for direct attacks on ships.

NOTIONAL CONCEPTS OF OPERATIONS AND ASSESSMENT OF CAPABILITIES

A first-order assessment of the capability to accomplish each mission with bombers follows. The assessment is based on a notional *concept of operations* for each mission that integrates the appropriate

sensors, engagement systems, weapons, dispensers, and munitions. Where applicable, the assessment differentiates between the following two cases:

- The bomber penetrates to the vicinity of the target and employs a short-range missile with an IIR sensor and data link; a WSO controls the terminal engagement.
- The bomber stands off and uses a long-range cruise missile that relies on (1) an inertial system with GPS updates for mid-course guidance that places the missile in the basket and (2) an on-board engagement system with sensors and algorithms to complete the terminal engagement.[3]

Denying or Delaying Insertion, Reinforcement, and Supply of Enemy Forces by Land

Interdict roads. Roads can be interdicted by destroying bridges with unitary warheads and by emplacing extended-range mines, such as ERAM, along the targeted roads. Repeated interdiction attacks on road networks can be particularly effective in areas with few major routes and when the traffic is heavy, i.e., when a large number of forces must meet some predetermined schedule. Both of these conditions apply to eastern Poland, Korea around the demilitarized zone, and northwestern Iran.

Attack military units moving along roads. For the case of bombers penetrating to the vicinity of the target, the WSO can recognize with sensors on board the aircraft formations of vehicles moving or parked along roads. (The assumption is that intelligence sources, possibly including emplaced sensors, would already have identified the time when and place where military vehicles would likely occupy some designated stretches of road.) Based on the cueing from the sensors on board the aircraft, the WSO launches weapons and then controls the terminal engagement by means of data links from and to the weapon. With newly designed engagement systems, one WSO should be able to control two to three weapons at a time. For the case of the B-52, two crew stations could be devoted to the engagement process. Accordingly, up to six weapons could be controlled at one time.

[3]The dependence only on NAVSTAR, the constellation of satellites associated with the GPS, might not be deemed prudent because of the system's potential vulnerability. In this case, a self-contained guidance system, for example, TERCOM (a navigation system that fixes a position by sensing terrain contours) could be used to update the on-board inertial system. However, it probably would not be feasible to obtain TERCOM maps for all areas, and thus GPS is probably the much more robust solution, especially where short planning cycles are involved.

Attack of military units moving along roads is still possible but would not be as straightforward for the case of bombers using long-range standoff missiles. As this may be a particularly difficult mission to accomplish from standoff, the concept for doing so is described below in some detail.

The proposed approach is to use variants of existing long-range cruise missiles. A refurbished AGM-86B or a BGM-109 modified for B-52 carriage are likely candidates.[4] These missiles nominally weigh a little over 3000 pounds and can accommodate a 1000-pound payload for ranges up to 1000 kilometers.

The cruise missiles must be able to navigate to a basket—a specific stretch of road. Once a missile is in the basket, the on-board terminal engagement system must be able to recognize the stretch of road and then cause the missile to fly along the road. To get the missile to the basket, we propose to equip it with an inertial system with GPS updates. To recognize and follow the road, the missile would be equipped with one (or perhaps two) of the following sensors: IIR, imaging millimeter wave synthetic aperture radars, and/or CO_2 LADAR.

The engagement system on board the missile (a computer with appropriate algorithms that receives inputs from the on-board sensors) must identify valid targets for attack. A valid target could be defined simply as a stretch of road (or a choke point) that contains the required number of objects that look like vehicles.

After identifying the target (the stretch of road to be attacked), the on-board engagement system must command the missile to dispense CEB or SKEET munitions at proper intervals along the target. Once dispensed, the munitions accomplish their task of killing the various elements of the column of vehicles just as they would if a WSO controlled the engagement.

With standoff weapons, there can be no last-minute cueing on when and where to release weapons as is the case when a WSO observes the target with sensors on board the bomber. The lack of cueing places a much greater burden on external intelligence to identify specific stretches of roads that will be occupied when the standoff missile arrives.

The assessment of effectiveness is generally as follows. If an enemy unit is engaged in trailer march (i.e., tracked vehicles are on transporters), CEB munitions distributed along enemy columns on the road can achieve mobility (m) kills against the trucks, APCs, and transporters

[4]The AGM-86B (the ALCM now in the last stages of production) will be replaced, at least in part, by the advanced cruise missile (ACM).

and catastrophic (k) kills against the troops in the trucks. Moreover, the ammunition and fuel in transit may ignite or detonate. The CEBs would not, however, be effective against the tanks, whether on transporters or under their own power.

Each 1000-pound-payload standoff weapon equipped with CEBs could effectively attack around 150 meters of road, which might contain five vehicles spaced 30 meters apart (center to center) or more than ten vehicles concentrated at some choke point.[5] With the more capable short-range weapons (2000-pound-class payload), each weapon could effectively attack up to 250 meters of road.

SKEET munitions would be more effective and also could operate against all types of vehicles with warm engines, including tanks; however, the present SKEET might not be effective against the next generation of tanks with much heavier armor over the engines. This munition would serve best against formations in which tanks were proceeding under their own power, rather than in trailer march. With efficient dispensing of the SKEET munition, it should be possible to effectively attack a battalion-sized unit of 50 vehicles with three 1000-pound-payload weapons or with two 2000-pound weapons.

Interdict railroad networks by dropping bridges and emplacing mines along roadbeds. Interdiction of railroad lines would be especially useful where the enemy depended on a railroad system consisting of few major lines and few connecting links. The rail network in eastern Poland and North Korea are such cases. The railroad network could be interdicted by dropping bridges and emplacing time-delay or counting mines in the ballast at appropriate places along the rail lines to derail trains as they passed over the mines.[6]

An analysis of the rail network of eastern Poland demonstrates that dropping the rail bridges along the Vistula and San rivers and creating some 200 cuts in the rail network every three days could significantly reduce the throughput of rail traffic in that network. An important aspect of this concept is that the work trains dispatched to rescue the derailed trains would themselves be derailed for long periods and prevented from reaching the original derailment.

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[5]The assessment that each 1000-pound weapon equipped with CEBs could effectively attack around 150 meters of road (for example, by disabling at least two-thirds of the vehicles on the road) is based on the assumption that the weapon itself is smart enough to dispense the munitions more or less uniformly along the road, e.g. five or six munitions abreast every four meters. Thus, around ten weapons would be required to attack a battalion-sized unit of 50 vehicles stretched along 1500 meters of road. If the dispenser were even smarter and dispensed munitions more efficiently and only when the missile was about to pass over a particular vehicle, then perhaps three weapons (rather than ten) could effectively attack 50 vehicles in trailer march.

[6]Counting mines are designed to detonate after a specified number of events.

Each standoff missile could make one cut by implanting a stick of four to eight mines designed for that purpose in the ballast along the rails as the missile passed over the rail line. The four to eight mines would provide high confidence that at least one was in the proper position. With a short-range weapon and its larger payload, each weapon might be able to make two cuts.

Attack trains directly. The creation of large craters directly in front of moving trains would cause violent derailments. Either an AGM-130 missile with an I-2000 unitary warhead or a long-range cruise missile armed with a 1000-pound unitary warhead could make such a crater. Also, CEBs could be dispensed along trains to achieve mobility kills against the APCs and trucks on the flatcars and catastrophic kills against troops in passenger cars.

A CEB attack could prove particularly effective against the vehicles and troops on a train that had just been derailed, but before the troops could depart the scene. A WSO with data-link weapons might be able to orchestrate a sequenced attack with four short-range weapons (one with an I-2000 for derailment and three with CEBs) to attack the vehicles and troops on the train.

Denying Insertion, Reinforcement, and Supply of Enemy Forces by Sea

Mine harbors. B-52s with standoff missiles could accurately emplace various mines in harbors. The ATB could emplace the mines from short range.

Attack ships. With the Harpoon weapon, bombers have an effective means of sinking or disabling ships, given that the bombers can penetrate to within the range of the weapon.

Neutralizing Enemy Air Operations and Denying Insertion of Enemy Forces by Air

Attack airfield facilities and unsheltered aircraft and emplace mines. Both the WSO-operated missiles and the standoff cruise missile, when equipped with CEBs, could work effectively against aircraft, equipment, and vehicles parked on ramps or in revetments and against soft facilities, including above-ground POL. Both missiles could distribute mines over an airfield to temporarily stop aircraft from taking off or landing and to inhibit the repair of runways, taxiways, and other airfield facilities.

Around 12 weapons (one B-52G load) would represent an effective attack against the aircraft and facilities on a moderate-sized airfield.

Crater runways. Both missiles, when equipped with BKEP, could crater runways. Six to eight standoff weapons equipped with the proper terminal guidance could temporarily close the runways at a typical air base.

This assessment is based on the premise that, with the proper terminal guidance, one weapon could cause multiple cuts by flying *along* the runway, and two (or possibly three) weapons per runway (one on one side and one on the other, and perhaps one in the middle) could crater each runway to the extent that aircraft could not take off or land. How long before aircraft could again land or take off would depend to a large degree on the type of aircraft using the runway and base repair capabilities.

Attack aircraft in shelters and caves. Both missiles could be equipped with BKEP to barrage the areas where aircraft are sheltered. BKEP munitions that hit a shelter would penetrate through the protective cover and detonate inside to damage the aircraft in the shelter.

The WSO-directed I-2000 could destroy most aircraft shelters and close—at least temporarily—the entrance to caves in which aircraft were hidden.[7] A standoff missile equipped with appropriate on-board sensors, such as a CO_2 LADAR, coupled to a scene-matching on-board engagement system, could also close a cave entrance. However, the warhead would weigh 1000, rather than 2000 pounds, and produce less certain results.

Destroying High-Value Enemy Targets

Both WSO-operated weapons and long-range standoff missiles equipped with very accurate terminal guidance should have the capability to destroy specific high-value fixed targets with the required precision and confidence. Either should be able to place a unitary warhead within several feet of the designated point. Among other uses, such a capability would be valuable for attacking enemy command centers, leadership elements, and targets located in urban areas.

Providing Intermittent Air Support to Ground Forces

Lay down a pattern of fire. The WSO can direct the dispenser to lay down a pattern of fire in precisely the area designated by the friendly forces on the ground. Personnel on the ground can designate the area to be attacked in a variety of ways, including: (1) by location in a common grid; (2) by laser designation; (3) in relation to terrain

[7]This would not be true for the case in which the entrance to the cave was protected by a huge barrier some tens of feet in front.

features; and (4) by markers, such as panels or smoke. Within the pattern of fire, the CEBs will destroy troops and disable lightly armored vehicles and artillery. SKEET munitions are capable of targeting all vehicles with warm engines, including tanks.

On certain occasions, the United States might have to rely on heavy bombers to provide air support to indigenous ground forces. However, such air support would not be continuous or responsive to changing battlefield needs unless the bombers were able to loiter safely in the vicinity of the battlefield.

A standoff missile would probably not be used to support ground forces except in the most dire of circumstances. Because of the long flight time, the concept of laying down a pattern of fire in a designated area would not be operationally sound, except in a static situation. The problem of directing the missile to the designated area could conceivably be solved by using a common grid system—for example, GPS—to provide the missile with updates during flight. However, this would not solve the problem of whether a valid target would still be there when the missile arrived. In any case, standoff cruise missiles used in this role would lack the required confidence of not endangering friendly troops.

Summary of Capabilities

Figure 1 summarizes the capabilities of bombers equipped with modern conventional weapons and munitions, assuming that the appropriate weapons and munitions were developed and acquired. The statements in the figure generally apply to both short-range data-link weapons and long-range cruise missiles, except that the standoff missile would probably not be used to support friendly ground forces. In most cases, fewer short-range weapons would be required than long-range weapons, thanks to the formers' larger payload and more efficient use of that payload.

PENETRATION VERSUS STANDOFF

In many air defense environments, B-52s will be unable to penetrate to the vicinity of the target so that the WSO can control the data-link weapon. In these circumstances, long-range standoff missiles operating autonomously must be used.

The standoff mode of engagement significantly reduces the bomber's capability. First, within the constraints on the size and total weight of a missile that can be carried efficiently on a bomber (around 3000

Mission / Munition	Disrupt/deny movement and supply of enemy forces by land	Deny insertion and supply of enemy forces by sea	Neutralize enemy air operations and deny insertion of enemy forces by air	Provide air support to ground forces	Destroy high-value targets
CEB	Attack columns on roads — Kill trucks, APCs, and transporters — Kill troops in trucks Attack units on trains — Kill troops, APCs, and trucks on cars		Barrage selected areas of airfields — Destroy parked aircraft and soft support facilities, including POL	Lay down pattern of munitions on designated areas — Kill troops, APCs, and trucks	
BKEP			Crater runways — Deny takeoff and landing Barrage shelter areas — Kill aircraft in shelters		
SKEET	Attack columns on roads — Disable all vehicles with warm engines, including tanks			Provide pattern of fire on concentrations of vehicles — Disable all vehicles with warm engines, including tanks	
Appropriate Mines	Emplace mines along railroads and roads — Delay/disrupt moving vehicles and trains	Emplace mines in harbors — Deny ship transit	Emplacing mines on parking areas, taxiways, runways — Stop aircraft from operating — Inhibit airfield repair		
Unitary Warheads	Attack bridges and tunnels — Interdict rail and road networks Create craters in front of trains — Derail trains	Attack ships with Harpoon missiles — Sink, damage ships	Attack command posts in bunkers		Attack specific targets with precision

Fig. 1—Capabilities of bombers armed with modern conventional weapons

pounds), payload must be traded for range, thus reducing the payload of munitions on long-range cruise missiles. In addition, the remaining payload cannot be used as effectively in the standoff weapon, because the WSO is no longer in the loop. On the other hand, witn standoff missiles, simultaneous attack of multiple targets is less constrained: An on-board engagement system controls each missile rather than one or two WSOs controlling a few missiles each.

We have purposely avoided any attempt to specify the circumstances in which bombers will penetrate and those in which they will stand off, as that is a command decision depending on the specific case at hand. The situation argues, in the case of the B-52, for a mix of standoff cruise missiles and short-range weapons. The standoff cruise missiles would need ranges of around 1000 kilometers and could be based on derivatives of the AGM-86 or BGM-109 or other cruise missiles. The short-range data-link weapons could be based on derivatives of the AGM-130 or other data-link weapons. Since gravity bombs are readily available, it may be appropriate in some circumstances to barrage designated areas with these bombs.

With the advent of the ATB, the far more capable and flexible engagement process involving WSOs can be used almost exclusively. By penetrating to the vicinity of the target, the WSO can efficiently control the terminal engagement by virtue of the data link with the sensors on board the weapon.

BOMBER OPERATIONS AND TANKER SUPPORT

Tankers need not be used extensively to support bomber operations, and in most instances only CONUS-based tankers need be involved. Several specific missions will be examined to illustrate this point.

Bombers could be used to support the Supreme Allied Command in Europe (SACEUR) by interdicting the Soviet follow-on forces traversing the roads and railroad networks in eastern Poland and Czechoslovakia. To carry out this interdiction mission, they would drop selected rail and road bridges and place mines to cut the main east-west rail lines. For such missions, the bombers would operate from CONUS bases (see Fig. 2).

The B-52s would depart the United States so as to arrive in northern Italy the first night after Soviet troops crossed the border into Eastern Europe. They would launch the long-range cruise missiles from Italy and recover in the United States. If required, the mission could be accomplished using only CONUS-based tankers. One tanker would refuel one B-52 over the Atlantic on exit from the United States

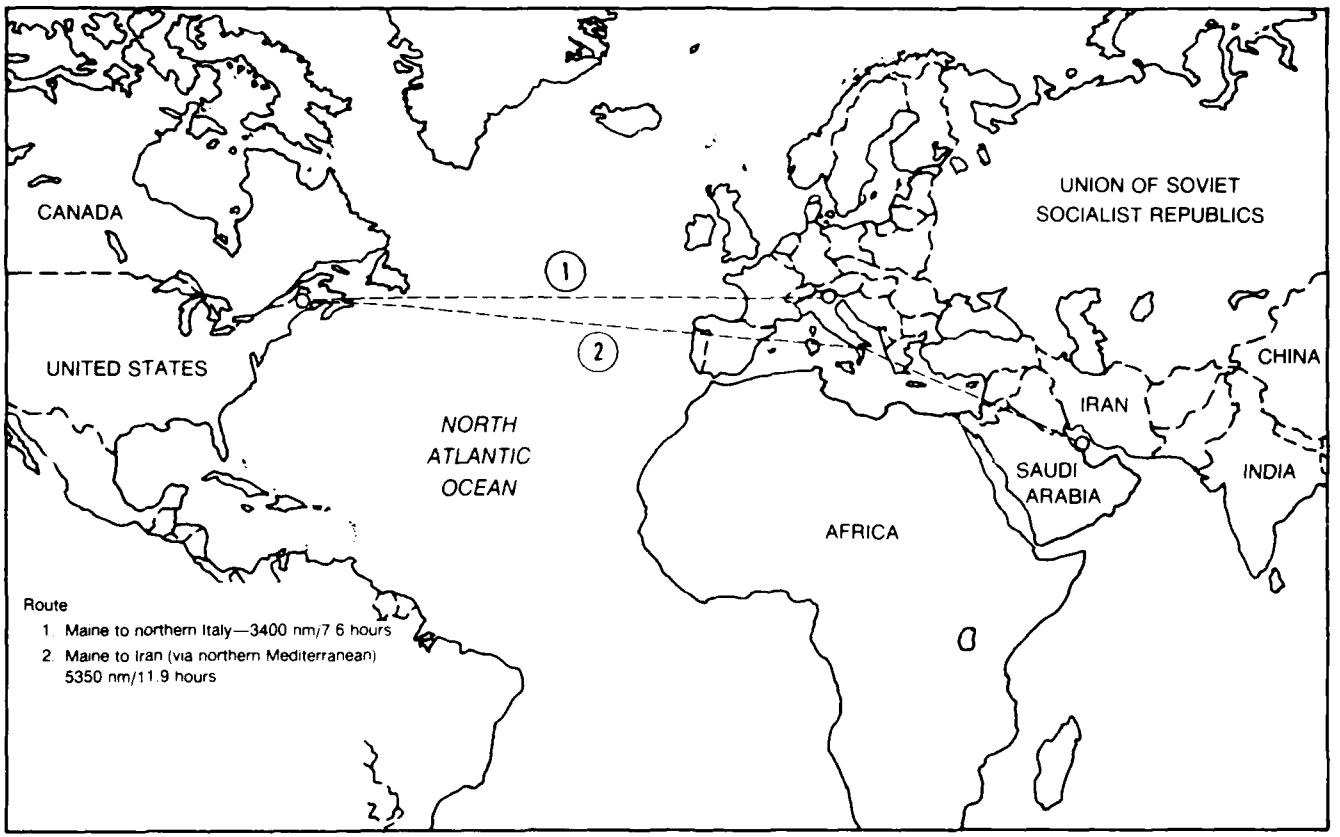


Fig. 2 - Distance/time for B-52 missions in Poland and Iran

and the same tanker could refuel the same B-52 over the Atlantic on return. Thus, only one tanker for each B-52 need be assigned to this mission.

For attacks in northern Iran, the bombers would proceed from the United States directly to the area designated for the launch of their long-range standoff missiles; they would recover at some base in the region and continue operations from that base. For such a mission, the bombers would require a one-for-one refueling at altitude off the east coast of the United States and possibly another refueling after egress from the designated launch area. Any required tankers could operate out of the base at which the bombers recovered. If more indirect routes from the United States to the launch area off Iran were required to avoid enemy interception, an additional en route refueling might be needed.

For attacks in North Korea or Southeast Asia, the bombers could originate from either Guam or the United States (see Fig. 3). If the bombers attacking targets in Southeast Asia came from the United States, tankers would have to refuel them off the U.S. coast and over Guam. Bombers attacking North Korea from U.S. bases would have to be refueled off the United States. In either case, the bombers would recover at Guam and would continue operations from that base.

Bombers attacking targets in Southeast Asia from Guam would require tanker support from Guam. Bombers operating against North Korea from Guam would not require tanker support.

POTENTIAL B-52 FORCE COST AND LONGEVITY

We believe the costs of a conventionally armed B-52 bomber force would be affordable. According to the Air Force, it costs about $6 million per year to maintain, operate, and support a B-52G bomber.[8] Therefore, the ten-year operating, maintenance, and support costs of a force of 75 B-52Gs would be about $4.5 billion.

We estimate that the fly-away cost for each smart, conventionally armed long-range cruise missile (such as a variant of the Boeing AGM-86B ALCM or the General Dynamics BGM-109 Tomahawk) might run as high as $1.2 million. Thus, to equip a 75-aircraft bomber force with 3000 conventionally armed cruise missiles might cost an additional $3.6 billion. This would bring the total weapon and ten-year operating costs of a 75-aircraft B-52 force to around $8 billion. The

[8]See United States General Accounting Office, *Strategic Bombers: Early Retirement of B-52G Bombers*, Briefing Report to the Honorable John Kasich, House of Representatives, Washington, D.C., October 1986, pp. 4–5, 10.

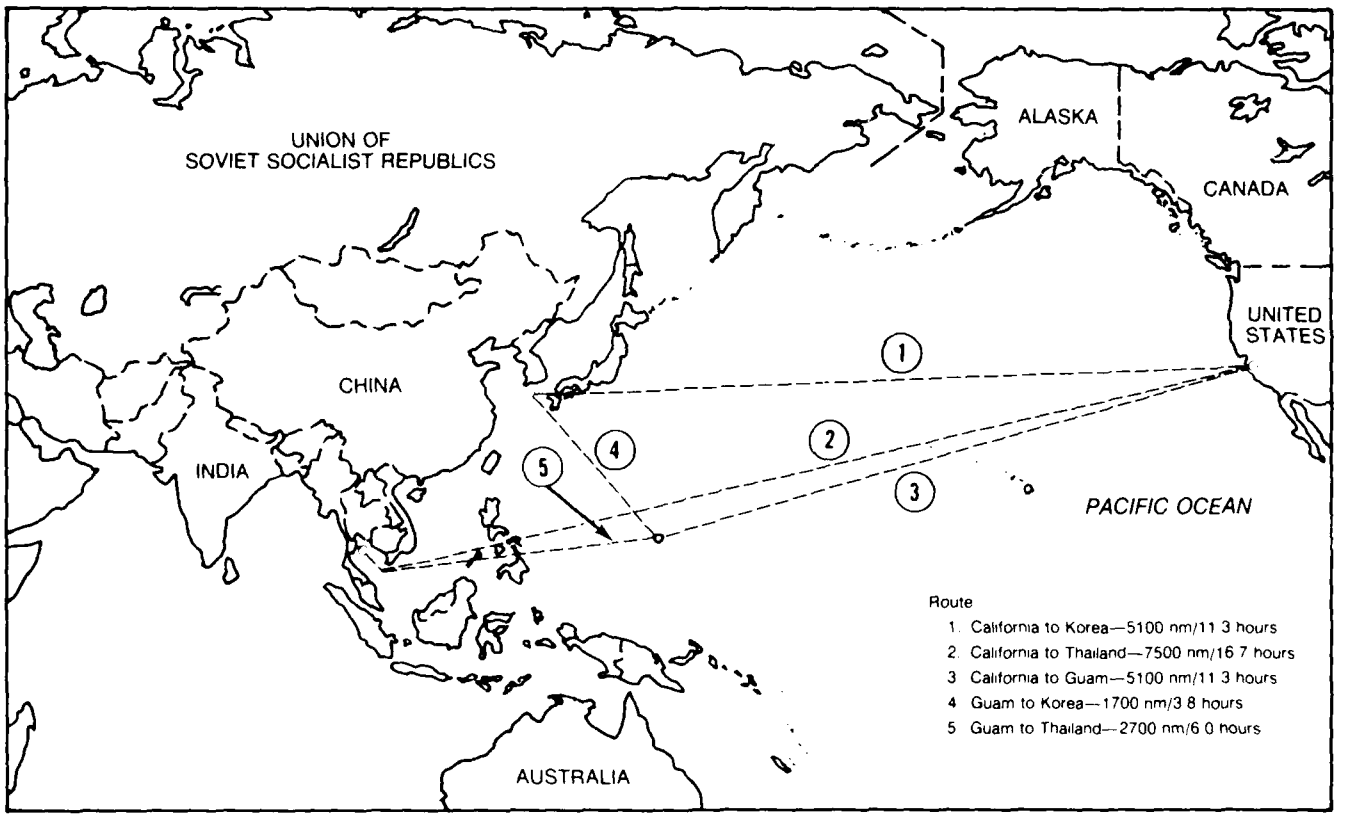


Fig. 3—Distance/time for B-52 missions in Korea and Southeast Asia

ten-year operating and weapon cost of a larger force of 100 B-52s equipped with 4000 cruise missiles would be around $11 billion.

The use of B-52 aircraft already in the U.S. inventory would in itself provide a substantial cost saving as additional new aircraft would not have to be procured for the initial conventional bomber force. The B-52s have all undergone modifications that have significantly extended their service life. They now have a sufficient service life remaining to perform the conventional missions until ATBs become available to be assigned to the dedicated conventional force.[9]

RECOMMENDED AIR FORCE ACTIONS

The technology for the necessary missiles, sensors, scene-matching systems, dispensers, and munitions has reached the point where the Air Force can undertake a full-scale development program to integrate these various building blocks so as to provide both an effective conventionally armed data-link missile and a standoff cruise missile.

We propose an evolutionary approach: The B-52s should be provided the capability as soon as possible to accomplish the easier missions set forth in this report and then gain additional capabilities on an evolutionary basis. For example, the Air Force could attain the capability to precisely attack high-value targets within a few years by equipping B-52Gs with data-link weapons operated by weapon-system operators. A variant of the AGM-130 is an example. Later, this same capability should be possible with standoff cruise missiles equipped with scene-matching systems accurate enough for precise attack on designated buildings. At least from an engineering standpoint, such standoff missiles could be provided within three or four years.

Additional capabilities could be achieved with time. The Air Force could later incorporate more accurate scene-matching systems so as to gain the capability to destroy bridges from standoff. The development of an appropriate mine to effectively cut rail lines should be possible in five years. In due time, as on-board engagement systems become more intelligent and dispensers become more versatile, the Air Force could achieve the capability to attack columns of military vehicles on roads.

Obtaining these additional capabilities would require undertaking engineering development programs as distinct from continuing to engage in projects to advance the state of technology.

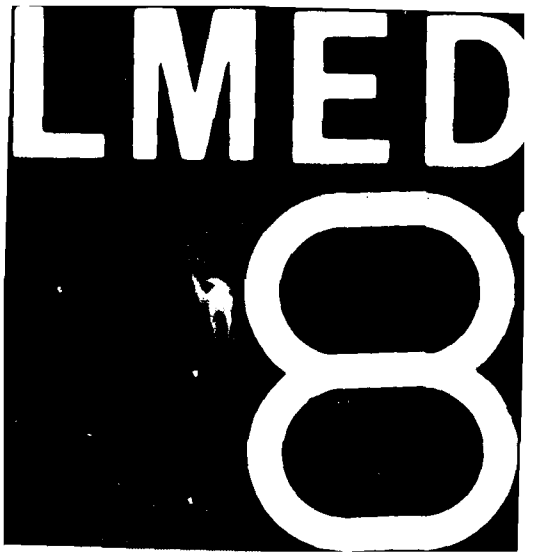
[9]According to information that SAC provided to the authors in November 1986, the Boeing Corporation now estimates B-52G life at 35,400 hours and B-52H life at 31,500 hours.

To move forward requires:

- A consensus and decision at the highest levels to undertake a program to organize, equip, and train B-52 bomber units and later ATBs with modern conventional weapons to achieve the stated missions. Specifically, a *firm* decision is needed in the near future to retain and equip with modern conventional weapons the 69 B-52Gs scheduled to be dedicated to conventional missions.
- An agreed concept of operations (down to the functional specifications of subsystems) of how each mission is to be accomplished.
- A sustained dedication and priority to pursue a continuing program to provide B-52s and ATBs, on an evolutionary basis, the capability to execute the specified missions according to the agreed concept of operations.

In particular, the USAF should take the following initial actions:

- Retain an adequate number of B-52s.
- Formulate the operational concepts for B-52s equipped with long-range cruise missiles to accomplish the specified missions.
- Initially equip some B-52Gs with an off-the-shelf data-link weapon.
- Develop and acquire air-launched long-range cruise missiles and equip these missiles on an evolutionary basis with appropriate sensors, on-board engagement systems, and versatile dispensers to provide the standoff required for B-52s to operate in high-threat environments.
- Complete the development and then acquire the warheads and munitions to be used in these missiles.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